Chemistry > Big idea CCR: Chemical reactions > Topic CCR2: Understanding reactions

Key concept (age 11-14)
CCR2.2: Combustion

What's the big idea?

A big idea in chemistry is that during a chemical reaction, atoms are rearranged resulting in the formation of a new substance or substances.

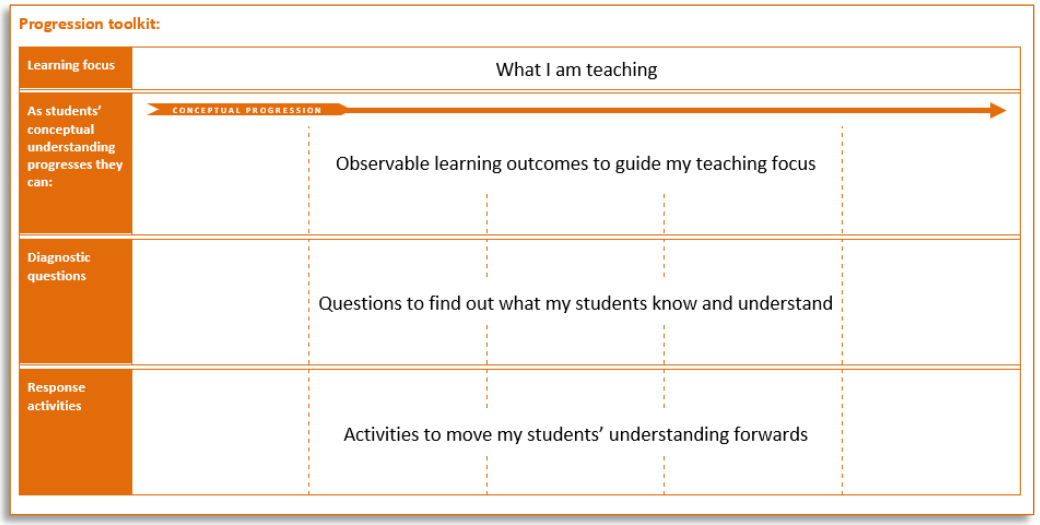
How does this key concept develop understanding of the big idea?

This key concept develops the big idea by introducing combustion as a specific type of reaction in which atoms from a fuel and oxygen rearrange to form new products.

The conceptual progression starts by checking understanding of the need for oxygen in order for combustion to occur. It then supports the development of the idea that combustion involves the combination of one reactant with oxygen in order to enable explanation of an increase in measured mass following combustion.

Using the progression toolkit to support student learning

Use diagnostic questions to identify quickly where your students are in their conceptual progression. Then decide how to best focus and sequence your teaching. Use further diagnostic questions and response activities to move student understanding forwards.



Progression toolkit: Combustion

Learning focus	During combustion new products are formed from the combination of oxygen with the fuel, resulting in an increase in measured mass.				
As students' conceptual understanding progresses they can:	CONCEPTUAL PROGRESSION →				
	Recognise that burning requires oxygen. **P**	Recognise that burning of a metal involves combination with oxygen.	Predict an increase in mass following burning of a metal.	Explain the products of combustion of a fuel.	Predict that products of combustion will have a greater mass than the original fuel due to combination with oxygen.
Diagnostic questions	Matches in space	Oxygen need	Burning iron wool	Sulfur impurity	Exhaust gases
Response activities		Does it burn?	Iron wool balance	Burning sulfur	Burning carbon

Key:

P Prior understanding from earlier stages of learning

B Bridge to later stages of learning

What's the science story?

The products of combustion arise from the rearrangement of atoms from both the reactant (e.g. the fuel) and oxygen. During combustion, a substance reacts with oxygen from the air, so the measured mass will increase.

What does the research say?

The book 'Children's Ideas in Science' (Driver, Guesne and Tiberghien, 1985) reports research findings that say that about a third of students in the 11-12 year old age group did not appear to have difficulty in understanding that oxygen is needed for burning to take place. However, reasons varied and did not always indicate that they thought of oxygen as being actively involved in the process. Their responses to a question relating to change in mass upon burning indicated difficulties in understanding that burning involved chemical combination with oxygen.

The first learning outcome checks for prior understanding that burning requires oxygen. The next learning outcomes build on understanding about the rearrangement of atoms to explain combustion in terms of combination with oxidation and the products of combustion of a hydrocarbon fuel. The final learning outcomes link this understanding to in order to predict an increase in measured mass when a fuel burns.

Guidance notes

The understanding in this key concept is supported by ideas from key concept CPS4.2: Conservation of mass. It is important for students to understand that even if the observed mass increases during combustion the total mass of reactants (including oxygen) is still equal to the total mass of the product.

References

Driver, R., Guesne, E. and Tiberghien, A. (1985). *Children's Ideas in Science,* Milton Keynes, UK: Open University Press.